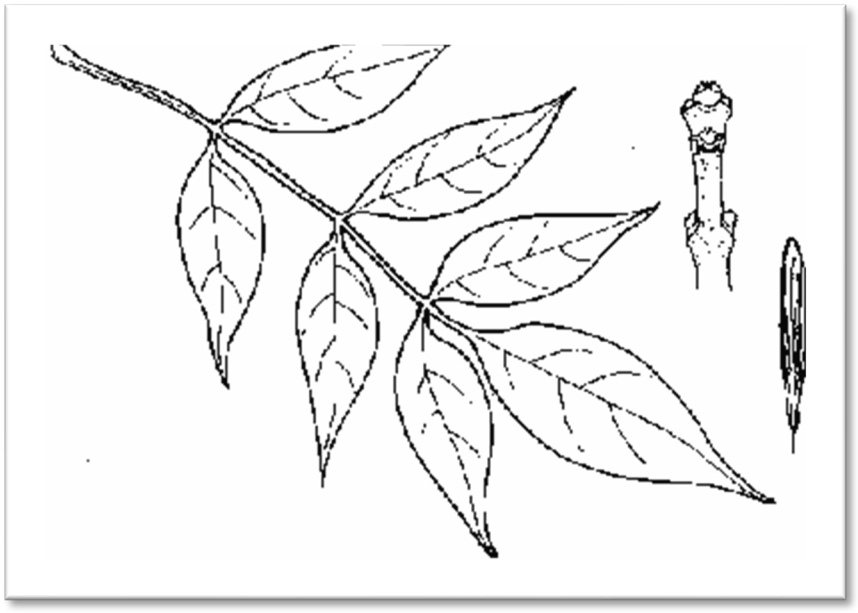
Biological Evaluation of Ash At The National Arboretum, Washington, DC



Prepared by

Richard M. Turcotte
Entomologist

USDA Forest Service
Northeastern Area State and Private Forestry
Forest Health Protection
180 Canfield Street
Morgantown, WV 26505

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Abstract

During the summer of 2012 U.S. Forest Service and National Arboretum staff conducted a survey for the emerald ash borer (EAB) and an intensive ash (*Fraxinus* spp.) inventory at the Arboretum. The purpose of this project was to 1) assess the location and extent of ash within the Arboretum, 2) use purple panel traps to monitoring for the emerald ash borer within the Arboretum; and 3) determine the need for ash treatments to protect and maintain the ash resources within the National Arboretum. Field surveys identified 78 high value specimen trees in its cultivated gardens and another 130 (>4 inch dbh) trees in the native woodlands areas. No EAB was detected in the panel traps or were any signs or symptoms consistent with the emerald ash borer (e.g. epicormic branching, woodpecker activity, bark splitting, or boring insects) noted. Since EAB has been found in the District of Columbia it is recommend that a comprehensive ash management plan be developed and a chemical suppression/prevention treatment plan be put into place to protect high value specimen trees.

Purpose and Need

The Morgantown Field Office (MFO) received a request from Christopher Carley, Supervisory Horticulturist with the United States National Arboretum, whose staff were concerned about potential ash mortality related to the recent finding of the emerald ash borer, *Agrilus planipennis* (Fairmaire)(Coleoptera: Buprestidae), in Washington, DC in 2011. This project was undertaken by the MFO to address this request and evaluate what management options were available to protect and maintain the ash resources at the National Arboretum.

Project Location/Description

The National Arboretum is located in eastern Washington, DC. (38º54'N, -76º58'W). The Arboretum covers approximately 446 acres of which 242 acres are forested (Figure 1). The Arboretum is divided into cultivated gardens (collections) and native woodland areas. The Arboretum was established by an Act of Congress in 1927. The mission of the National Arboretum is to serve the public need for scientific research, education, and gardens that conserve and showcase plants to enhance the environment. The Arboretum lies on Mount Hamilton (Goodrum, 1950) within the oak-hickory ecological forest type which is associated with oaks (*Quercus* spp.) yellow popular (*Liriodendron tulipifera* L.) and northern hardwood forest cover type (Smith et al., 1983). At the time of its development in the early 1930's the site was dominated by groves of mature maple (*Acer* spp.) American beech (*Fagus grandifolia* Ehrh.), and oak (Goodrum, 1950). Prior to establishment the site had been extensively modified by human activity related to farming and urban development.

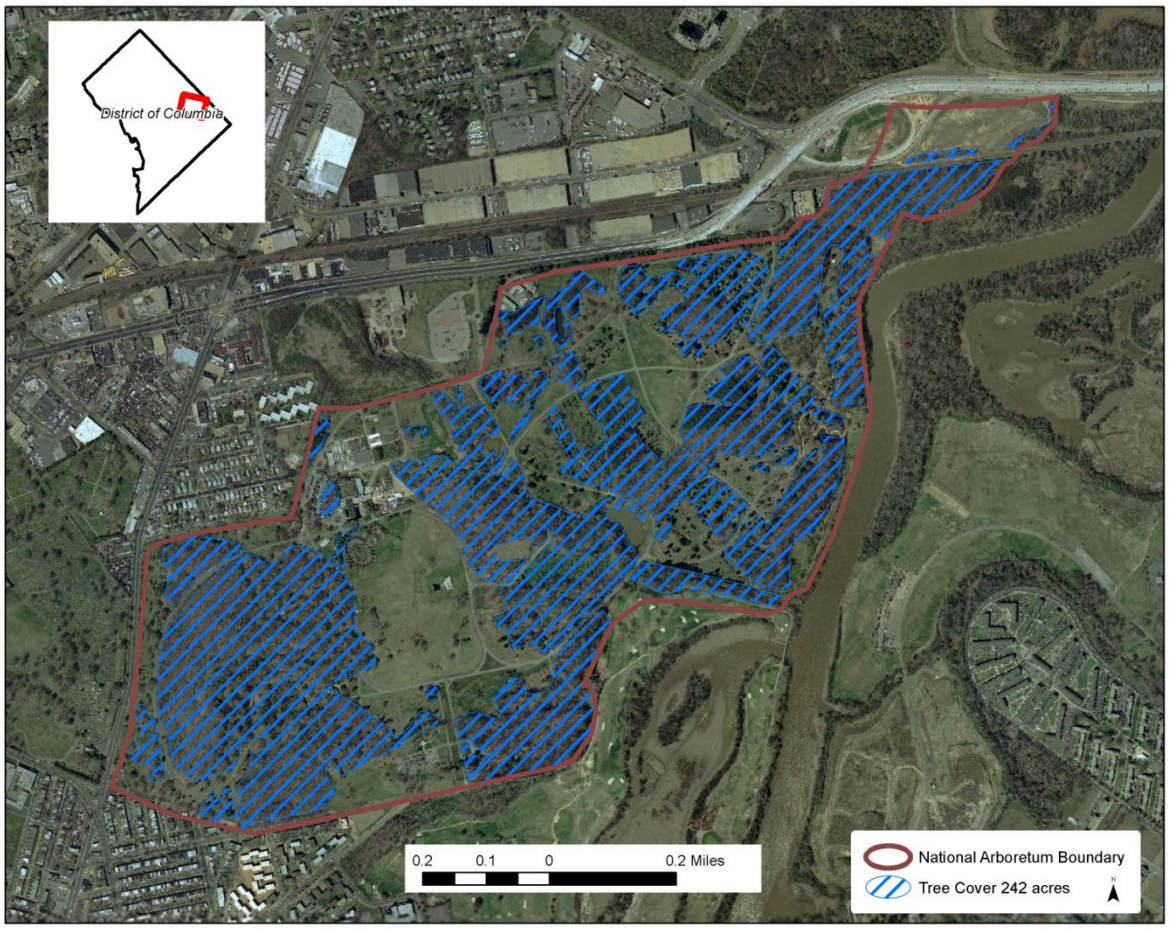

Figure 1. United States National Arboretum, Washington DC.

Project Objectives

The objectives for this evaluation were to 1) assess the location and extent of ash (*Fraxinus* spp.) within the Arboretum, 2) use purple panel traps to monitoring for the emerald ash borer (EAB) within the Arboretum; and 3) determine the need for ash treatments to protect and maintain the ash resources within the National Arboretum.

Project Methods

ARCMAP data

We used ARCMAP® data provide by U.S. Department of Agriculture, National Arboretum for the boundary and cultivated gardens (collections) and native woodland areas. These boundary areas were then overlaid with National Agricultural Imagery Program (NAIP) data and Google earth imagery which was used to digitize tree cover and calculate wooded acreage.

Ash survey

In the summer and fall of 2012 an intensive ash inventory was conducted by Arboretum staff. All ash trees > 1 inch in diameter at breast height (DBH) were identified, size classed, visual inspected for signs and symptoms of EAB, and its geo-coordinates taken using a handheld GPS unit.

Figure 2. Purple panel trap.

Trapping

During an initial site visit on May 15, 2012, 4 attractant-baited purple panel traps (Figure 2.) were deployed within ash trees at the National Arboretum. Traps were checked for EAB and the lures replaced every 60 days till they were removed on August 23, 2012.

Results

Ash Survey

The Arboretum currently has 5 species of native ash, blue ash (*F. quadrangulata* Michx.), green ash (*F. pennsylvania* Marsh.), pumpkin ash (*F. profunda (*Bush) Bush), California ash (*F. dipetala* Hook. & Arn.) and white ash (*F. americana* L.) along with 10 species of exotic ash, Chinese ash (*F.chinensis* Roxb.), European ash (*F. excelsior* L.), Manchurian ash (*F. mandshurica* Rupr.), Manna ash, (*F. ornus* L.), Japanese ash (*F. longicuspis* Sieb. & Zucc.), *F. paxiana* Lingelsh., *F. stylosa* Lingelsh., Chinese flower ash (*F. sieboldiana* Blume.), *F. insularis* Hemsl., and bunge ash (*F. bungeana* DC.) in their collection and native woodland areas. Field surveys of the National Arboretum identified 78 high value specimen trees in its cultivated

gardens and another 130 (>4 inch dbh) trees in the native woodlands areas (Figure 3). Ash trees

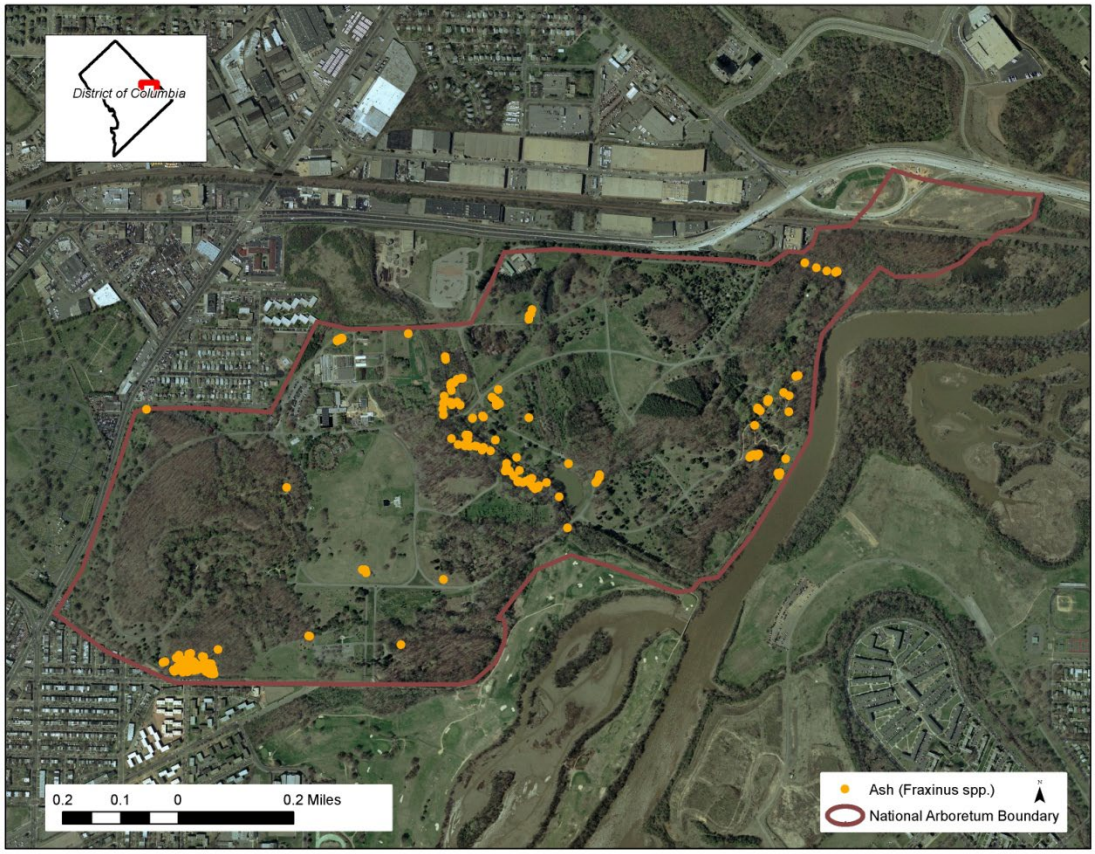

Figure 3. Locations of ash (*Fraxinus* spp.) trees within the National Arboretum

were clustered in three main areas of the Arboretum, along Hickey creek valley running through the middle of the Arboretum, along the southwestern M Street boundary and the eastern boundary along the Anacostia River.

The median ash tree was 8 inches in diameter with trees ranging in size from 1 to 52 inches DBH. The smaller size classes of ash trees occurred mostly in the cultivated gardens with the larger size classes occurring in the native woodlands (Figure 4.).

Insect activity, dieback and defoliation was noted on some of the ash trees inventoried but no signs or symptoms consistent with the EAB (e.g. epicormic branching, woodpecker activity, bark splitting, or boring insects) were noted in any of the ash trees surveyed.

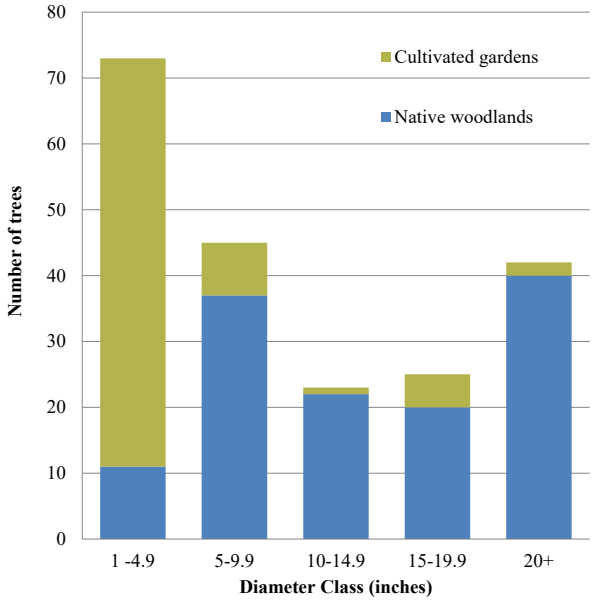

Figure 4. Size distribution of ash species within the National Arboretum.

Trapping

No emerald ash borers were found on any of the purple panel traps deployed at the Arboretum.

Discussion

This evaluation was undertaken in response to a request to identify the amount of ash present and to determine what could be done to protect and maintain this resource at the National Arboretum. This began by surveying for EAB and inventorying the site to identify the condition and amount of the ash resource present. Based on these results it appears that the majority of the ash trees present are healthy and that EAB has not yet reached the Arboretum. That being said it is extremely difficult to detect EAB during the early part of an infestation and monitoring activities and a public awareness campaign should continue.

With the arrival of EAB in the District of Columbia, the National Arboretum will be forced to respond to its arrival to some degree, regardless of the strategy they adopt. Dead trees within the Arboretum will present a threat to public safety and must be dealt with. The loss of ash from the Arboretum will impact the collections and permanently alter the native woodland areas for related species. Sudden changes in canopy cover may result in negative impacts to local plant communities. Addressing these concerns will require a well-conceived management plan with specific goals and implementation mechanisms (e.g. management options (selected removal), wood utilization, material disposal, replanting, and canopy replacement strategy).

This evaluation was initiated to look at protecting the maintaining the ash resources. Currently the only available options for protecting trees are limited to individual tree chemical treatments. The basic guidelines used to decide when to treat for emerald ash borer is when you are within 25 miles of a known infestation. Since EAB has been found in the District of Columbia it is recommend that a comprehensive ash management plan be developed and a chemical suppression/prevention treatment plan be put into place as soon as possible.

Management Options

For 2012, three management options have been evaluated for managing EAB at the National Arboretum. The intervention options are offered based on the following objectives: 1) protect high value cultivated garden trees (collection); and 2) protect native woodland ash trees. Each option is discussed below.

No action option

In this option emerald ash borer is allowed to infest susceptible ash trees within the Arboretum. Should this option be selected, it is likely that all susceptible ash trees would be attacked and die as a result of EAB. This would result in the loss of not only high value collection trees but native woodland trees which would result in hazard trees in public areas, and a reduction in overstory canopy and soft mast production in these areas.

Chemical insecticide option

The second and third options are to use chemical insecticides to prevent and control EAB. Chemical control options for EAB were reviewed by (Herms et al., 2009) and include: noninvasive systematic basal trunk sprays, soil-applied systematic insecticides, trunk-injected systematic insecticides, and protective cover sprays. Dinotefuran (Safari®) is labeled for controlling EAB and has shown variable results. It is sprayed on the lower 5 or 6 feet of trunk. Soil injection of imidacloprid has showed variable results and requires careful attention to soil conditions and tree DBH. Soil injections should be applied 2-4 in. below the soil surface to stay available to feeder roots, soil should be moist to facilitate uptake, and chemical amounts should be increased or combined with other treatment methods for trees larger than 15 in. diameter at breast height (DBH). Trunk injection of emamectin benzoate in mid-May or early June provides the most consistent control of EAB, according to test trials at Michigan State and Ohio State Universities. This was the only treatment that provided multiple years of protection (up to three years). Protective cover sprays have been shown to prevent EAB from entering trees in Michigan State University studies, but have no effect on larvae feeding under the bark. Spraying the entire tree is most effective, but there is considerable drift associated with this process.

Alternatives

Alternative 1.	No action
Alternative 2.	Treat all cultivated garden and woodland ash trees.
Alternative 3.	Limits treatments to all cultivated garden trees and the treatment of native woodland ash trees > 15 inches diameter at breast height.

Recommendations

Although visual and trapping surveys (purple panel traps) within the Arboretum have not detected EAB, it is recommended that monitoring activities continue and that a comprehensive ash management plan be developed and a chemical suppression/prevention treatment plan be put into place as soon as possible. In addition it is recommended that the public awareness campaign continue along with monitoring for EAB by visual surveys and using attractant-baited purple panel traps. It is recommended that the use of *Cerceris fumipennis,* (Hymenoptera: Crabronidae), a wasp that hunts buprestid beetles be explored. *C. fumipennisis* a native insect that bring beetles, including EAB back to their nests to feed. Nests can be located and monitored to detect the presence of EAB.

Alternative 3 is recommend based on the following considerations.

1) Based on the known presence of EAB within the District of Columbia and difficulty in detecting this insect at the early stages of infestation.

2) This alterative protects the high value cultivated garden ash and retains large specimen trees in the woodland areas.

Species Evaluation

Emerald Ash Borer (EAB) *Agrilus planipennis* (Fairmaire) is a wood-boring beetle from eastern Asia (Poland and McCullough, 2006) that is causing severe mortality in North American ash (Tluczek et al., 2011). EAB affects all species and diameter classes of ash and often kills both healthy and stressed trees within three to five years after becoming infested (Siegert et al., 2006). Based on the data from USDA Animal and Plant Health Inspection Service (APHIS), EAB emerge around mid-June and are present through mid-August (www.emeraldashborer.info). Adult beetles are slender, elongate, and bright green and feed on ash foliage in patches along the leaf margins (Kovacs et al., 2010). Adult beetles usually live for about three weeks and females

lay about 60-90 eggs (McCullough and Katovich, 2004). Eggs hatch in 7-10 days and larvae chew through the bark and feed on phloem and outer sapwood for several weeks, creating S-shaped galleries packed with frass (Bauer et al., 2004). Larvae are white to cream-colored, 10-segmented, and flattened. Larvae overwinter in shallow chambers in the outer sapwood or bark on thick-barked trees(Bauer et al., 2004). EAB pupate in late April or May and adults emerge 1-2 weeks after pupation through D-shaped exit holes (McCullough and Katovich, 2004).

In addition to causing severe economic damage, there are ecological consequences associated with the loss of ash from North American forests. Studies show that ash provides food and habitat for several bird and mammal species (Faanes, 1984; Rumble and Gobeille, 1998). Forty-three native arthropod species are at high risk due to their association with ash for breeding or feeding (Gandhi et al., 2010). In addition, ash contributes to nutrient cycling in hardwood forests (Reiners and Reiners, 1970).

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